

# Summary

This thesis reports transport in ultrathin single crystalline nanowires of gold ( $\sim 2\text{nm}$ ). These nanowires were fabricated using an oriented attachment process whereby nanoparticles of appropriate dimensions join in a linear fashion to form long and stable wires. The main motivation was to study the role of electron-electron interactions on the transport mechanism in case of a metallic system, as one approaches dimensions closer to the Fermi wavelength. The study forms the first of its kind in a simple metallic system of this dimension.

Indeed, several new features have been obtained in this regard: Chapter 4 reports a breakdown of Fermi liquid state in such a system opening up possibilities of exotic states constituted by a strongly correlated Tomonaga-Luttinger liquid. We report consistent scaling of current-voltage curves, characteristic of such a phase and even resonant tunneling in such structures. The study reports the first observation of a correlated electron liquid in a metal, which has been observed only in semiconductors and polymer wires till date. Chapter 5 discusses the possibility of tuning the transport mechanism in these wires via a controlled change in the growth process. We show that using appropriate growth mechanisms, we can have a localized ground state as well, where variable range hopping is the dominant transport mechanism. Possibility of structural transitions in ultrathin wires is a field that has garnered considerable interest due to simulations. We present a highly sensitive tool in the form of electrical noise and its higher order statistics that can act as a detector of structural transitions. This has been thoroughly studied in case of conventional shape memory systems in Chapter 6. Preliminary noise studies on the nanowires have been reported in Chapter 7.